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UTILITY PATENT APPLICATION TRANSMITTAL

*Only for new nonprovisional applications under 37 C.F.R. § 1.53(b)

Attorney Docket No 1002-171B
 First Inventor or Application Identifier Zehner
 Title CELLULOSIC/POLYMER COMPOSITE MATERIAL
 Express Mail Label No EL039914361US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents

ADDRESS TO
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 Washington, DC 20231

- 1 ☒ • Fee Transmittal Form (e.g., PTO/SB/17)
 (Submit an original and a duplicate for fee processing)
- 2 ☒ Specification [Total Pages 12]
 (preferred arrangement set forth below)
- Descriptive title of the Invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
- 3 ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 4]
- 4 Oath or Declaration [Total Pages 2]
- a ☒ Newly executed (original or copy)
- b ☐ Copy from a prior application (37 C.F.R. § 1.63(d))
 (for continuation/divisional with Box 16 completed)
- i ☐ DELETION OF INVENTOR(S)
 Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b)

- 5 ☐ Microfiche Computer Program (Appendix)
- 6 Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
- a ☐ Computer Readable Copy
- b ☐ Paper Copy (identical to computer copy)
- c ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

- 7 ☐ Assignment Papers (cover sheet & document(s))
- 8 ☐ 37 C.F.R. § 373(b) Statement ☐ Power of Attorney
 (when there is an assignee)
- 9 ☐ English Translation Document (if applicable)
- 10 ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
- 11 ☐ Preliminary Amendment
- 12 ☒ Return Receipt Postcard (MPEP 503)
 (Should be specifically itemized)
- 13 ☐ Small Entity Statement(s) ☐ Statement filed in prior application, Status still proper and desired
 (PTO/SB/09-12)
- 14 ☐ Certified Copy of Priority Document(s)
 (if foreign priority is claimed)
- 15 ☐ Other

* NOTE FOR ITEMS 12 & 13: IN ORDER TO BE ENTITLED TO PAY SMALL ENTITY FEES, A SMALL ENTITY STATEMENT IS REQUIRED (37 C.F.R. § 1.27), EXCEPT IF ONE FILED IN A PRIOR APPLICATION IS RELIED UPON (37 C.F.R. § 1.28)

16 If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No _____ / _____

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Signature		Date	May 22, 2000

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APPLICATION FOR UNITED STATES LETTERS PATENT

FOR

CELLULOSIC/POLYMER COMPOSITE MATERIAL

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CELLULOSIC/POLYMER COMPOSITE MATERIAL

Inventor: Burch E. Zehner

This Application claims the benefit of U.S. Provisional Application No. 60/135,443, filed May 22, 1999.

BACKGROUND AND SUMMARY OF THE INVENTION

5 The present invention relates generally to wood replacement materials, and more particularly, to cellulosic/polymer composite materials. The present invention will be described primarily with reference to wood flour/polyvinyl chloride (PVC) composites and wood flour/polypropylene composites. However, the present invention includes several different formulations and material composites including, but not limited to, PVC formulations and polypropylene formulations that include an inorganic filler in addition to the cellulosic material.

10 The supply of natural woods for construction and other purposes is dwindling. As a result, many are concerned about conserving the world's forests, and the cost of natural woods has risen. In light of these factors, a tremendous demand has developed in recent years for cellulosic/polymer composites that exhibit the look and feel of natural woods.

15 Cellulosic/polymer composites are used as replacements for all-natural wood, particle board, wafer board, and other similar materials. For example, U.S. Patent Nos. 3,908,902, 4,091,153, 4,686,251, 4,708,623, 5,002,713, 5,055,247, 5,087,400, and 5,151,238 relate to processes for making wood replacement products. As compared to natural woods, cellulosic/polymer composites offer superior resistance to wear and tear. In particular, cellulosic/polymer composites have enhanced resistance to moisture. In fact, it is well known
20 that the retention of moisture is a primary cause of the warping, splintering, and discoloration of

natural woods. Moreover, cellulosic/polymer composites may be sawed, sanded, shaped, turned, fastened, and finished in the same manner as natural woods. Therefore, cellulosic/polymer composites are commonly used for applications such as interior and exterior decorative house moldings, picture frames, furniture, porch decks, deck railings, window moldings, window components, door components, roofing structures, building siding, and other suitable indoor and outdoor items.

The present invention provides cellulosic/polymer composite materials that can be produced in a commercially reasonable environment. One example of the present invention is a cellulosic/PVC composite, and another example of the present invention is a cellulosic/polypropylene composite. The cellulosic/polymer compositions of the present invention can be processed and shaped into resultant products having desired appearance, strength, durability, and weatherability. In addition, the present invention provides improved methods of making such cellulosic/polymer composites.

In addition to the novel features and advantages mentioned above, other objects and advantages of the present invention will be readily apparent from the following descriptions of the drawings and preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a side elevation view of a siding unit made with a cellulosic/polymer composite of the present invention;

Figure 2 is an exterior plan view of the siding unit of Figure 1;

Figure 3 is an interior plan view of the siding unit of Figure 1; and

Figure 4 is a side elevation view of another siding unit made with a cellulosic/polymer composite of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT(S)

The present invention is directed to cellulosic/polymer composite materials. The present invention also includes methods of manufacturing cellulosic/polymer composite materials. The cellulosic/polymer composite materials of the present invention can be used as a substitute for natural wood, particle board, wafer board, and other similar materials. For example, the composites of the present invention can be used to make interior and exterior decorative house moldings, picture frames, furniture, porch decks, deck railings, window moldings, window components, door components, roofing structures, building siding, and other suitable indoor and outdoor items.

Figures 1 through 3 show an example of a siding unit 10 that can be made with a composite of the present invention. Figure 4 shows another example of a siding unit 20 that can be made with a composite of the present invention. It shall be understood that the siding units may be comprised of any desired number of rows or courses. As shown in Figures 1 through 4, at least one backer 12, 22 may optionally be secured to the inside of at least one respective facing panel 14, 24. A backer may be comprised of a sufficiently rigid, insulating material such as expanded or extruded polystyrene foam, fiberglass, cardboard, a fire retardant grade of polyurethane foam, or any other suitable, conventional, or similar material.

The materials that may be used to make the composites of the present invention include, but are not limited to, cellulosic fillers, polymers, inorganic fillers, cross-linking agents, lubricants, process aids, stabilizers, accelerators, inhibitors, enhancers, compatibilizers, blowing

agents, foaming agents, thermosetting materials, and other suitable materials. Examples of cellulosic fillers include sawdust, newspapers, alfalfa, wheat pulp, wood chips, wood fibers, wood particles, ground wood, wood flour, wood flakes, wood veneers, wood laminates, paper, cardboard, straw, cotton, rice hulls, coconut shells, peanut shells, bagass, plant fibers, bamboo fiber, palm fiber, kenaf, and other similar materials. Examples of polymers include multilayer films, high density polyethylene (HDPE), polypropylene, PVC, low density polyethylene (LDPE), chlorinated polyvinyl chloride (CPVC), acrylonitrile butadiene styrene (ABS), ethyl-vinyl acetate, other similar copolymers, other similar, suitable, or conventional thermoplastic materials, and formulations that incorporate any of the aforementioned polymers. Examples of inorganic fillers include talc, calcium carbonate, kaolin clay, magnesium oxide, titanium dioxide, silica, mica, barium sulfate, and other similar, suitable, or conventional materials. Examples of cross-linking agents include polyurethanes, such as isocyanates, phenolic resins, unsaturated polyesters, epoxy resins, and other similar, suitable, or conventional materials. Combinations of the aforementioned materials are also examples of cross-linking agents. Examples of lubricants include zinc stearate, calcium stearate, esters, amide wax, paraffin wax, ethylene bis-stearamide, and other similar, suitable, or conventional materials. Examples of stabilizers include tin stabilizers, lead and metal soaps such as barium, cadmium, and zinc, and other similar, suitable, or conventional materials. In addition, examples of process aids include acrylic modifiers and other similar, suitable, or conventional materials.

One embodiment of the present invention is a cellulosic/PVC composite material. The composite material may include at least one cellulosic filler in the amount of about 30% to about 60% by weight, more preferably about 40% to about 50% by weight, and still more preferably

about 48% to about 50% by weight. The composite may also include a PVC material in the amount of about 40% to about 70% by weight, more preferably about 50% to about 60% by weight, and still more preferably about 50% to about 52% by weight.

The cellulosic filler(s) may be dried to a desired moisture content. For example, the cellulosic filler(s) may be dried to about 0.5% to about 3% moisture content by weight, more preferably to about 1% to about 2% moisture content by weight. However, it is appreciated that the cellulosic filler(s) may have a moisture content less than about 0.5% by weight or greater than about 3% by weight.

The PVC material can be made by mixing a PVC resin, at least one stabilizer, at least one lubricant, at least one process aid, and optional other ingredients in a mixer. An example of a mixer is a high intensity mixer such as those made by Littleford Day Inc. or Henschel Mixers America Inc. As an example, the mechanically induced friction may heat the ingredients to a temperature between about 200° F and about 230° F. After mixing, the ingredients may be cooled to ambient temperature.

The PVC material may include stabilizer(s) in an amount of about 1 to about 10 parts, more preferably about 3 to about 5 parts, per 100 parts of the PVC resin. The lubricant(s) may be present in an amount of about 2 to about 12 parts, more preferably about 4 to about 8 parts, per 100 parts of the PVC resin. Also, process aid(s) may be included in an amount of about 0.5 to about 8 parts, more preferably about 1 to about 3 parts, per 100 parts of the PVC resin. Optionally, at least one inorganic filler may be added in an amount of up to about 10 parts, more preferably up to about 5 parts, per 100 parts of the PVC resin.

The PVC resin may have any desired inherent viscosity. The inherent viscosity is preferably between about 0.6 and 1.1 and more preferably between about 0.7 and 0.9. Nevertheless, it is appreciated that the inherent viscosity of the PVC resin may be less than 0.6 or greater than 1.1.

5 The cellulosic filler(s) and the PVC material may be mixed together prior to being further processed such as by extrusion or molding. For example, a low intensity mixer may be used to mix the cellulosic filler(s) and the PVC material. An example of a low intensity mixer is a ribbon blender.

10 The composite material may be processed in an extruder, a compression molding apparatus, or any other suitable, similar, or conventional apparatus. An example of an extruder is a conical, twin screw, counter-rotating extruder with a vent. A force feed hopper or crammer or any other suitable, similar, or conventional apparatus may be used to feed the materials into the extruder. The composite material may be extruded through a die system. The die system may have a compaction ratio between about 2:1 and 4:1. The die system may include an extended die
15 land to provide sufficient back pressure for a uniform melt as well as compaction and shaping of the melt.

20 Another example of the present invention is a cellulosic/polypropylene composite material. The composite material may be comprised of at least one cellulosic filler in an amount of about 30% to about 70% by weight, more preferably about 40% to about 50% by weight. Additionally, the composite material may be comprised of a polypropylene material in an amount of about 30% to about 70% by weight, more preferably about 50% to about 60% by weight.

The cellulosic filler(s) may be dried to a desired moisture content. For example, the cellulosic filler(s) may be dried to about 0.5% to about 3% moisture content by weight, more preferably to about 1% to about 2% moisture content by weight. However, it is appreciated that the cellulosic filler(s) may have a moisture content less than about 0.5% by weight or greater than about 3% by weight.

The polypropylene material includes at least one lubricant in an amount of about 10 to about 20 parts per 100 parts of a polypropylene resin. More preferably, the polypropylene material includes at least one lubricant in an amount of about 14 to about 19 parts per 100 parts of the polypropylene resin. The polypropylene material may also include at least one inorganic filler in an amount up to about 70 parts, more preferably between about 20 and 60 parts, per 100 parts of the polypropylene resin.

Optionally, the polypropylene material may be mixed together in a mixer such as any of those described above. After the cellulosic filler(s) are dried to a desired level, the cellulosic filler(s) and the polypropylene material may be mixed together using a mixer such as the above-described low or high intensity mixers. The composite material may then be processed by extrusion, compression molding, or any other similar, suitable, or conventional processing technique. The extrusion system may include any of the optional or preferred features of the above-described embodiment of the present invention.

EXAMPLES

A cellulosic/PVC composite was made which comprised about 111 parts of a cellulosic filler and about 112 parts of a PVC material. The PVC material was comprised of about 100 parts of a PVC resin, about 4 parts stabilizer, about 6 parts lubricants, and about 2 parts process aids. The cellulosic filler and the PVC material were mixed together and extruded. The resultant product exhibited desired appearance, strength, durability, and weatherability.

A cellulosic/polypropylene composite was also made which comprised about 143 parts of a cellulosic filler and about 136 parts of a polypropylene material. The polypropylene material was comprised of about 100 parts polypropylene resin, about 15 parts lubricants, and about 21 parts of an inorganic filler. The composite was made by first drying the wood flour to about 2% or less moisture content. The polypropylene resin, lubricants, and inorganic filler were then added and blended for about 5 minutes. Next, the composite material was extruded to form an article having desired appearance, strength, durability, and weatherability.

The preferred embodiments herein disclosed are not intended to be exhaustive or to unnecessarily limit the scope of the invention. The preferred embodiments were chosen and described in order to explain the principles of the present invention so that others skilled in the art may practice the invention. Having shown and described preferred embodiments of the present invention, those skilled in the art will realize that many variations and modifications may be made to affect the described invention. Many of those variations and modifications will provide the same result and fall within the spirit of the invention. It is the intention, therefore, to limit the invention only as indicated by the scope of the claims.

WHAT IS CLAIMED IS:

1. A composite comprising:

at least one cellulosic filler in an amount of about 30% to about 60% by weight of said composite; and

5 at least one polyvinyl chloride material in an amount of about 40% to about 70% by weight of said composite, said at least one polyvinyl chloride material comprised of at least one stabilizer in an amount of about 1 to about 10 parts per 100 parts of a polyvinyl chloride resin, at least one lubricant in an amount of about 2 to about 12 parts per 100 parts of said polyvinyl chloride resin, and at least one process aid in an amount of about 0.5 to about 8 parts per 100 parts of said polyvinyl chloride resin.

2. The composite of claim 1 wherein said at least one cellulosic filler is in an amount of about 40% to about 50% by weight of said composite.

3. The composite of claim 2 wherein said at least one cellulosic filler is in an amount of about 48% to about 50% by weight of said composite.

4. The composite of claim 1 wherein said at least one cellulosic filler is wood flour.

5. The composite of claim 1 wherein said at least one polyvinyl chloride material is in an amount of about 50% to about 60% by weight of said composite.

6. The composite of claim 5 wherein said at least one polyvinyl chloride material is in an amount of about 50% to about 52% by weight of said composite.

20 7. The composite of claim 1 wherein said polyvinyl chloride resin of said at least one polyvinyl chloride material has an inherent viscosity of about 0.6 to about 1.1.

8. The composite of claim 7 wherein said polyvinyl chloride resin of said at least one polyvinyl chloride material has an inherent viscosity of about 0.7 to about 0.9.
9. The composite of claim 1 wherein said at least one stabilizer is in an amount of about 3 to about 5 parts per 100 parts of said polyvinyl chloride resin.
10. The composite of claim 1 wherein said at least one lubricant is in an amount of about 4 to about 8 parts per 100 parts of said polyvinyl chloride resin.
11. The composite of claim 1 wherein said at least one process aid is in an amount of about 1 to about 3 parts per 100 parts of said polyvinyl chloride resin.
12. The composite of claim 1 wherein said at least one polyvinyl chloride material is further comprised of at least one inorganic filler in an amount up to about 10 parts per 100 parts of said polyvinyl chloride resin.
13. The composite of claim 1 wherein:
- said at least one cellulosic filler is in an amount of about 40% to about 50% by weight of said composite; and
- said at least one polyvinyl chloride material is in an amount of about 50% to about 60% by weight of said composite, said at least one polyvinyl chloride material being comprised of said at least one stabilizer in an amount of about 3 to about 5 parts per 100 parts of said polyvinyl chloride resin, said at least one lubricant in an amount of about 4 to about 8 parts per 100 parts of said polyvinyl chloride resin, and said at least one process aid in an amount of about 1 to about 3 parts per 100 parts of said polyvinyl chloride resin.

14. A composite comprising:

at least one cellulosic filler in an amount of about 30% to about 70% by weight of said composite; and

at least one polypropylene material in an amount of about 30% to about 70% by weight of said composite, said at least one polypropylene material comprised of at least one lubricant in an amount of about 10 to about 20 parts per 100 parts of a polypropylene resin.

15. The composite of claim 14 wherein said at least one cellulosic filler is in an amount of about 40% to about 50% by weight of said composite.

16. The composite of 14 wherein said at least one cellulosic filler is wood flour.

17. The composite of claim 14 wherein said at least one polypropylene material is in an amount of about 50% to about 60% by weight of said composite.

18. The composite of claim 14 wherein said at least one lubricant is in an amount of about 14 to about 19 parts per 100 parts of said polypropylene resin.

19. The composite of claim 14 wherein said at least one polypropylene material is further comprised of at least one inorganic filler in an amount up to about 70 parts per 100 parts of said polypropylene resin.

20. The composite of claim 19 wherein said at least one inorganic filler is in an amount of about 20 to about 60 parts per 100 parts of said polypropylene resin.

ABSTRACT

The present invention includes various formulations of cellulosic/polymer composite materials. One embodiment of the present invention is a cellulosic/PVC composite material. This composite material may include at least one cellulosic filler in the amount of about 30% to about 60% by weight and a PVC material in the amount of about 40% to about 70% by weight. The PVC material may include about 1 to about 10 parts stabilizer(s) per 100 parts of the PVC resin, about 2 to about 12 parts lubricant(s) per 100 parts of the PVC resin, and about 0.5 to about 8 parts process aid(s) per 100 parts of the PVC resin. Another embodiment of the present invention is a cellulosic/polypropylene composite material. This composite material is comprised of at least one cellulosic filler in an amount of about 30% to about 70% by weight and a polypropylene material in an amount of about 30% to about 70% by weight. The polypropylene material includes at least one lubricant in an amount of about 10 to about 20 parts per 100 parts of a polypropylene resin.

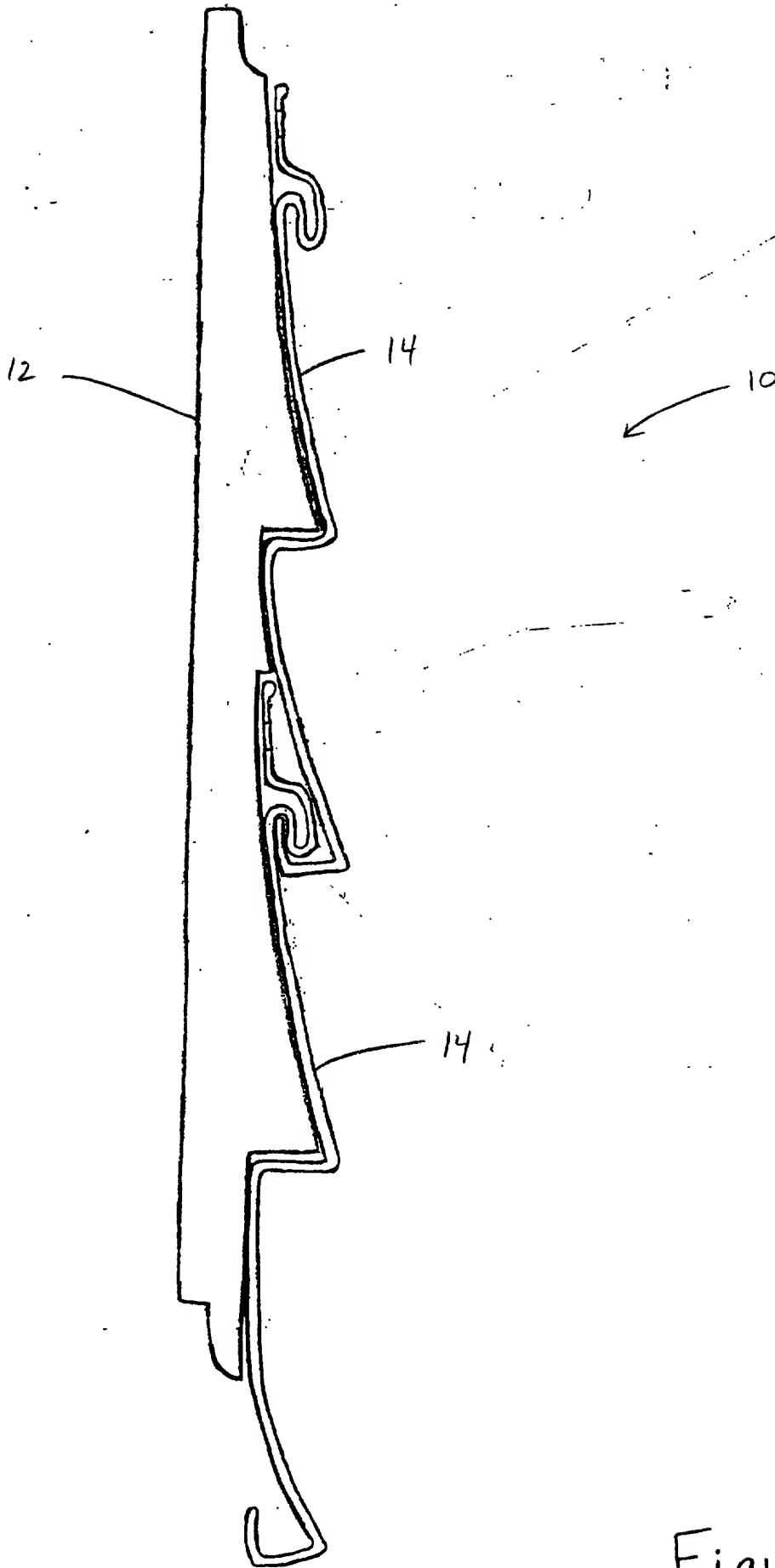


Figure 1

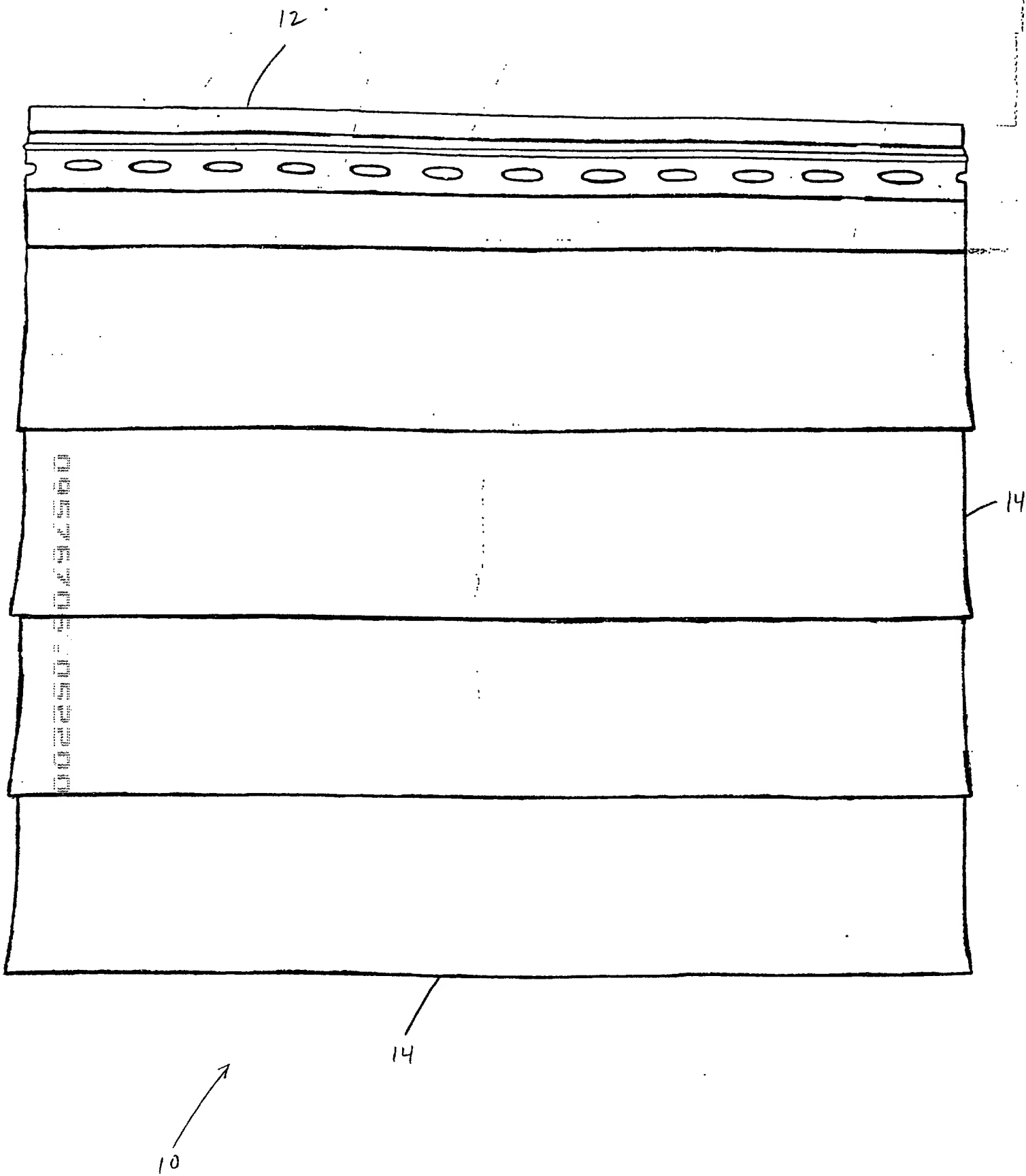


Figure 2

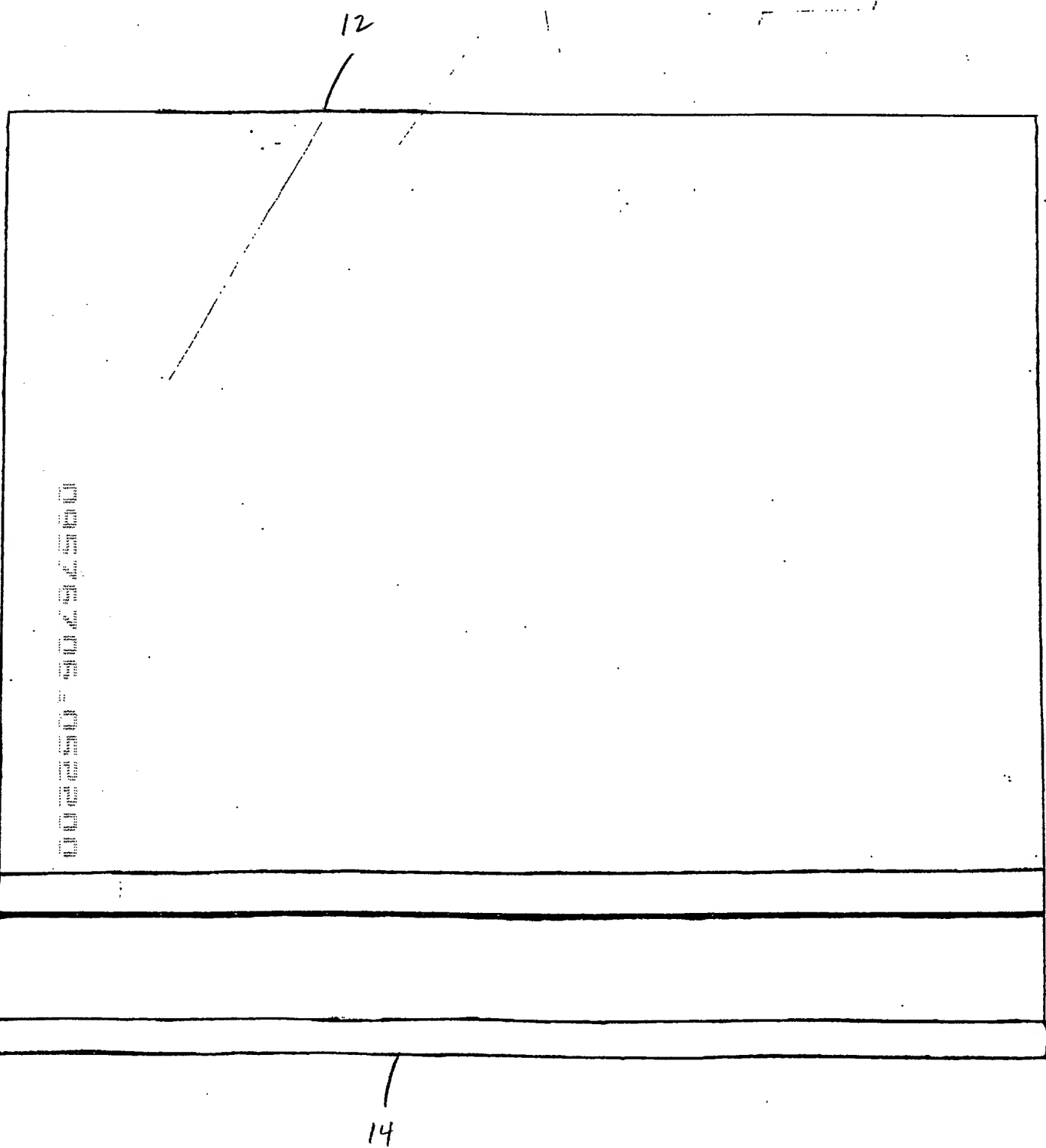


Figure 3

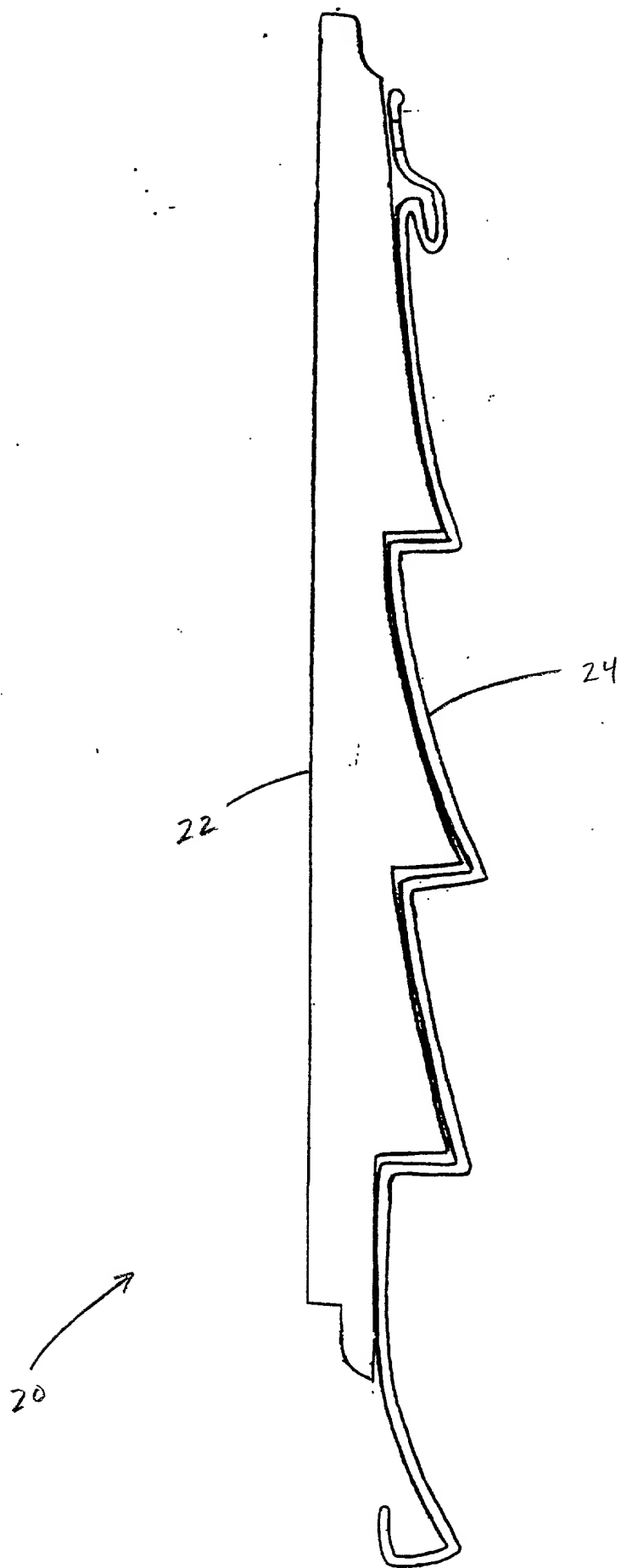


Figure 4

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Attorney Docket Number 1002-171B

First Named Inventor Zehner

COMPLETE IF KNOWN

Application Number /

Filing Date May 22, 2000

Group Art Unit

Examiner Name

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

CELLULOSIC/POLYMER COMPOSITE MATERIAL

the specification of which (Title of the Invention)

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I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56

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			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Application Number(s)	Filing Date (MM/DD/YYYY)	
60/135,443	05/22/1999	<input type="checkbox"/> Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto

[Page 1 of 2]

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DECLARATION -- Utility or Design Patent Application

I hereby claim the benefit under 35 U S C 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U S C 112, 1 acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)

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As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith

☐ Customer Number

OR

☒ Registered practitioner(s) name/registration number listed below

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Name	Registration Number	Name	Registration Number
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Jeffrey C. Norris	42,039		

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U S C 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon

Name of Sole or First Inventor:

☐ A petition has been filed for this unsigned inventor

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		ZIP	43230
		Country	USA

☐ Additional inventors are being named on the supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto